

CURATION OF MICROSCOPIC ASTROMATERIALS BY NASA: “GATHERING DUST SINCE 1981”.

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Introduction: Employing the philosophy that “Small is Beautiful”, NASA has been collecting and curating microscopic astromaterials since 1981. These active collections now include interplanetary dust collected in Earth’s stratosphere by U-2, ER-2 and WB-57F aircraft (the Cosmic Dust Program – our motto is “Gathering dust since 1981”), comet Wild-2 coma dust (the Stardust Mission), modern interstellar dust (also the Stardust Mission), asteroid Itokawa regolith dust (the Hayabusa Mission – joint curation with JAXA-ISAS), and interplanetary dust impact features on recovered portions of the following spacecraft: Skylab, the Solar Maximum Satellite, the Palapa Satellite, the Long Duration Exposure Facility (LDEF), the MIR Space Station, the International Space Station, and the Hubble Space Telescope (all in the Space Exposed Hardware Laboratory).

The NASA “Dust” Collections: We briefly describe recent curation developments in these programs.

Cosmic Dust. We are announcing the availability of microtomed samples, and have lately focused collecting efforts on targeted collection targeting meteor showers as inexpensive comet sample return missions (most recently the Draconids, from comet Giacobini-Zinner [1]), and capturing samples without silicon oil [2] to eliminate organic and Si contamination.

Stardust Wild 2 Samples. A new web-based cometary compendium [3] is now being assembled and updated with peer-reviewed, non-peer reviewed, and curatorial documentation. Also, we now have a new routine method for terminal particle extraction. After extraction of a complete particle impact track in a “keystone” [4], a ~100µm thick cross-section of the keystone is cut out with a targeted particle. This thin aerogel “wafer” is more easily flattened and embedded with epoxy for microtomy than a whole keystone track. In addition, the entire track is left in a pristine state for detailed imaging and subsequent analyses.

Stardust Interstellar Collection. The interstellar preliminary exam (ISPE) is now over and general sample allocation has begun. Many of the identified tracks by the Stardust@home project [5] have yet to be extracted or analyzed. ISPE results are being added to the astromaterials database and are currently under peer review for publication.

Hayabusa. The NASA Hayabusa lab [6] is now operational. Unique collaboration between the NASA and JAXA-ISAS curatorial facilities provide sample availability from both agencies, and exchange of sample handling expertise.

Space Exposed Hardware. Careful curation (even of museum displays) permits sample analysis many years after hardware return to Earth. For example a recent sampling of the Stardust sample return capsule (SRC) lid (now on display at the Smithsonian Air and Space Museum) was required to characterize the compositions of secondary impacts in the Stardust interstellar dust collector.

References: [1] Bastien et al. 2013. Abstr. #1622 44th LPSC. [2] Messenger et al. 2012. Abstr. #2696 43rd LPSC.; Westphal et al. 2013. Abstr. #1686 44th LPSC. [3] Westphal et al. 2004. MAPS 39, 1375-1386. [4] Westphal et al. 2013 MAPS submitted. [5] De Gregorio et al. 2012. Abstr. #2020 43rd LPSC.